Symposium on Fire Effects to Obsidian

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Tom Origer and Dave Fredrickson, Organizers and Chairs.
The Effects of Fire/Heat on Obsidian.

For several decades, a number of researchers have examined the effects that fire/heat has on obsidian specimens. Some studies were focused on the after-effects of wildfires, some on controlled burns, and still others on conditions created under laboratory conditions. An understanding of the effects of fire/heat on obsidian specimens continues to gain in importance as land managers increasingly use fire to control fuel buildup in woodlands and forests and alter vegetation patterns (i.e., improve pastureland). This session brings together researchers to describe their work and findings in a setting conductive to discussion, debate, and sharing of information.

Benson, Arlene Humboldt-Toiyabe National Forest
Effects of Fire on Obsidian Hydration Rind Thickness

In September 1996, ninety obsidian samples were treated to low, moderate, and high intensity fire during a prescribed fire in a high mountain sagebrush environment. Thermocouples were used to record maximum temperatures reached at each sample during the burn. Then control samples were not treated to fire. The obsidian hydration rinds of all 100 samples included in the study were measured before and after the study. Changes in hydration rind thickness of both treated and untreated obsidian samples will be described and implications discussed.

Deal, Krista Eldorado National Forest
and Denise McLemore
Effects of Prescribed Burning on Obsidian and Implications for Reconstructing Past Landscape Conditions

Hydration bands on surface and near-surface obsidian often become diffused and unreadable following wildfires. The assumption has been that less intense fires, like those prescribed for management purposes, do not reach temperatures that would effect hydration bands, although there has been little data to support this assumption. The current study measured the effects to archaeological obsidian of both temperature and duration of heat in two prescribed burns with differing fuel loads. Preliminary results indicated that duration of exposure to heat, even at low temperature creates effects on hydration bands similar to those of elevated temperatures. These results have potential implications for expanding fire histories beyond the 400-year limit of tree-coring, for reconstructing prior landscape conditions and Indian burning practices, for archaeological interpretations, and for cultural resource and ecosystem management.

Fredrickson, David A. Sonoma State University
No abstract.

Green, Dee Warner Mountain Ranger District, USDA Forest Service
Re-Hydrated Obsidian Projectile Points on the Warner Mountains, California

Fire is the only known method, in the natural environment, which can remove hydration rinds from obsidian. In cases where early archaic projectile points show hydration rinds which reflect what is thought to be a much later time period, there is a probability that such points have been subjected to fire and then re-hydrated. This paper examines a collection of such points from the Warner Mountains of northeastern California. Distributions of all hydrated points, by watershed, are examined and plotted. The utility of re-hydrated points in studies of fire history is examined.

Halford, F. Kirk (with contributions from Anne S. Halford) Bureau of Land Management
The Trench Canyon Prescribed Burn: An Analysis of Fire Effects on Archaeological Resources Within the Sagebrush Steppe Community

Prescribed fire is becoming a common tool on Public Lands to manage fire behavior, fuel loading, and vegetation community associations. The effects of this management practice on archaeological resources is of concern. This paper will focus on the effects of a prescribed burn on the hydration birefringent rim of obsidian artifacts. In particular, this analysis addresses the differential effects of fire within three quantified fuel zones within late seral Great Basin sage (*artemisia tridentata* spp. tridentata) and upland sagebrush steppe community types.

Kelly, Roger National Park Service
An Overview of Obsidian Studies Within NPS Park Projects

From clumsy field experiments to higher-tech laboratory efforts, National Park Service archeological staff have explored heat effects upon obsidian for nearly two decades. Early assumptions and guesses have lead to systematic and organized data collecting, but mostly post-prescription burns or post-wildlife campaigns. What have we – as one agency – learned about changes or lack of change in obsidian materials as found within several California NPS park units? And also, what about the neighboring NPS park units elsewhere in the West where comparative data exist? Are we working better with our fire program colleagues as a result of greater understanding about obsidian and fire?

Loyd, Janine Sonoma State University Obsidian Laboratory
Rehydration of Burned Obsidian

Obsidian specimens have, no doubt, been exposed to fire during prehistoric and historic times, sometimes deliberately, but most often unintentionally as in the case of wildfires. Three basic questions present themselves when looking at the effects of obsidian having been exposed to fire. Does obsidian lose hydration when it is burned? Does obsidian have the ability to rehydrate after it has been exposed to fire? Does the temperature at which the obsidian was burned effect obsidian rehydration? This paper presents the results of experiments designed to address these questions.

Origer, Tom Sonoma State University.
No abstract.

Schroder, Sue Ann Sonoma State University Obsidian Laboratory
A synthesis of Previous Studies that Explored the Effects of Fire on Obsidian: Where we've Been and Where We're Going

Some 15 unpublished and published documents related to fire/heat effects on obsidian were reviewed. Virtually each document described a different set of procedures that were used to determine whether fire/heat had affected hydration bands. The broad range of study procedures resulted in a shared conclusion – hydration bands were affected by fire/heat in some way. This paper will synthesize and describe analytical techniques and results of prior studies, with the intent of creating a solid foundation upon which future studies can be designed.

Shackley, M. Steven Archaeological XRF Laboratory, Phoebe Hearst Museum of Anthropology, University of California, Berkeley
and Carolyn Dillian
Thermal and Environmental Effects on Obsidian Geochemistry: Experimental and Archaeological Evidence

Recent EDXRF compositional studies of thermally altered archaeological obsidian from a number of late period sites in New Mexico and Arizona suggested that extreme thermal alteration may have been responsible for the depletion of elemental concentrations in the mid-Z x-ray region; a region where the most sensitive incompatible elements for the discrimination of archaeological obsidians reside. A stepped heating experiment subjecting samples of peraluminous to peralkaline artifact-quality obsidian to temperatures between 500EC and 1080EC indicated that at temperatures over 1000EC extreme mechanical changes occur, but the elemental composition in the mid-Z region does not vary beyond that expected in typical instrumental error. It appears that the apparent depletion of elemental concentrations in the archaeological specimens is due to EDXRF analysis of surface regions where melted sands bonded to the surface glass are incorporated into the results. If accurate analyses of burned obsidian artifacts are desired, the layer of melted sand from the depositional contexts must be removed before analysis.

Siefkin, Nelson National Park Service, Redwood National and State Parks
Manual Fuel Load Reduction as a Means of reducing the Effects of Fire on Obsidian Hydration: An Example from Lassen Volcanic National Park

Each of the four National Park Service Units of northern California – Lassen Volcanic National Park, Lava Beds National Monument, Redwood National Park and the Whiskeytown National Recreation Area – have prescribed fire programs which are conducted in areas with radically different vegetation types. As a result, the archeological survey strategy and the assumptions about the effects of fire on obsidain (and other cultural resources), in each unit, differ, as do the protective measures for these resources. In 1998, National Park Service and California Department of Forestry personnel removed a substantial amount of dead and down woody fuel from the surface of a large lithic scatter in Lassen Volcanic. In the absence of funds for obsidian

hydration, subsurface testing, and other studies, manual fuel load reduction may be a viable means of protecting obsidian from the effects of high temperature controlled burns and wildfires.

Skinner, Carl N. USFS, Pacific Southwest Research Station
and C. Phillip Weatherspoon
Fire Regimes and Fire History: Implications for Obsidian Hydration Dating

That fire can alter the hydration bands of obsidian specimens and thus affect the accuracy of dating is well known. It is also well known that before the 20th Century, fires were generally frequent (intervals of 5-20 years were common) i most forest, woodland, grassland, and shrub ecosystems of the western U.S. and especially California. Thus, it is likely that obsidian material that has been unprotected for more than a few decades on or near the soil surface has been exposed to fire. Only material that was buried and remained so after it was no longer used is likely to have escaped being influenced by fire. Fire intensity and duration of burning are highly variable and dependent upon the nature of the available fuels and weather conditions. Thus, high variability in dates inferred from hydration rinds should be expected from artifacts that have been exposed to the effects of past fires.

Smith, Jim California Department of Forestry and Fire Protection
Protecting Archeological Sites with Prescribed Fire

Past fire studies have shown that fire has a measurable effect on the hydration rind that forms on obsidian artifacts. Ecosystem management requires the reintroduction of fire through either prescribed fires or to allow wildfires to burn unabated. Wildfires are happenstance, and when occurring in areas where significant archeological resources are located, damage to sites can occur not only through suppression actions but from the unnatural fire intensities generated from accumulated fuel loading attributed to successful fire management practices. Wildfires therefore, do not afford the opportunity for archeologist to successfully protect known and newly discovered sites. Prescribed fire, through proper planning and site surveys, can protect archeological resources and allow the reintroduction of fires as a natural process in fire dependent ecosystems.

Soloman, Madeline Sonoma State University and California Department of Forestry and Fire Protection
Fire and Glass: Experimental Approaches to Understanding the Effects of Prescribed Burning on Obsidian Hydration Bands

During field experiments conducted in spring 1998 at Boggs Mountain Demonstration State Forests in Lake county, California, the hydration bands on obsidian artifacts placed in ground surface and subsurface contexts were not affected by exposure to prescribed burn conditions. Subsequent laboratory experiments at Sonoma State university suggested that gydration bands may not ve affected by prolonged exposure (24 hours) to temperatures of 100EC or below. These findings are considered in light of previous research on the effects of prescribed fire on obsidian hydration bands, and it is suggested that an examination of the specific prescription involved in a proposed burn is an essential factor in determining the likelihood that hydration

bands may become damaged during prescribed burning. As additional studies are needed to expand and refine our understanding of the effects of fire on hydration bands, several experimental approaches are proposed and discussed.

Steffen, Anastasia University of New Mexico
The Dome Fire Study: Extreme Forest Fire Effects on Jemez Obsidian

The 1996 Dome Fire burned over several obsidian source locations in Jemez Mountains of northern New Mexico. At one site, Capulin Quarry, the effects of the wildfire on obsidian were remarkably severe – including artifact bubbling, bloating, and complete destruction through vesiculation. This paper presents these effects along with an exploration of why obsidian at this source (Rabbit Mountain / Cerro Toledo rhyolite) had such a volatile response during this forest fire.